GEOTECHNICAL ENGINEERING INVESTIGATION
TRAFFIC OPERATION SYSTEM FOUNDATION
RECOMMENDATIONS
I-580 ADVANCED TMP POLE PROJECT
ALAMEDA AND CONTRA COSTA COUNTIES,
CALIFORNIA

For

TY Lin International/CCS
2010 Crown Canyon Place, Suite 350
San Ramon, California 94583

PARIKH CONSULTANTS, INC.
356 S. Milpitas Blvd., Milpitas, CA 95035
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July 7, 2006

Job No. 204150.GDR

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Geotechnical ■
Environmental ■
Materials Testing ■
Construction Inspection ■

T. Y. Lin International | CCS
2010 Crow Canyon Place, Suite 350
San Ramon, CA 94583

Job No.: 204150.GDR
July 7, 2006

Attn: Mr. Jim Pun

Subject: Geotechnical Engineering Investigation
Traffic Operation System Foundation Recommendations
I-580 Advanced TMP Pole Project
Alameda and Contra Costa Counties, California

Mr. Pun:

As per our discussion and your authorization, we are pleased to provide you our geotechnical engineering recommendations for the proposed Traffic Operation System at Route 580/680/84 and city streets in Alameda and Contra Costa Counties, California. Our services are provided in accordance with our overall scope and proposal for the proposed project. This report is prepared in addition to the project Geotechnical Design and Material Report.

Proposed Construction

As part of the I-580 HOV Lane Project, traffic operation systems and ramp metering systems are proposed at thirty different locations along Route 580, 680, 84 and city streets in Alameda and Contra Costa Counties, California. The project consists of new Closed Circuit Televisions (CCTV), Microwave Vehicle Detection Sensors (MVDS), Changeable Message Signs (CMS), Extinguishable Message Signs (EMS), Highway Advisory Radio (HAR), Ramp Metering, Interconnect, and Traffic Operation System (TOS) conduit for the City of Dublin. The general locations of the sign structures are shown on the Title and Location Map.

Scope of Work

We previously submitted a Geotechnical Design and Material Report for the I-580 HOV Lane Widening Project. The supplemental scope of our services in general was engineering analysis and recommendations for the proposed traffic operation system and sign structures.

Filed Exploration

The field exploration program consisted of drilling nineteen borings to a maximum depth of 9.1 m. Both portable drill rig (Minuteman) and truck-mounted drill rig were utilized to advance the borings. Selected samples were obtained from 64 mm (2.5-inch I.D., Modified California), and 35

mm (1.4-inch I.D., Standard Penetration) samplers at various depths. The MC & SPT samplers were driven into subsurface soils under the impact of a 63.5 kg (140-pound) hammer having a free fall of 76 cm (30 inches). (When correlating standard penetration data in similar soils, the blow counts for the Modified California Sampler can be taken as roughly twice that for the Standard Penetration Test in similar soils). The field investigation was conducted under the supervision of our field engineer who logged the test boring and prepared the samples for subsequent laboratory testing and evaluation.

Foundation Recommendations

- **CCTV, MVDS, EMS, HAR and Ramp Metering**

Based on the boring data and the overall geologic information, no special subsoil/adverse condition was noted. For the proposed CCTV, MVDS, EMS, HAR, and ramp metering, it is reasonable to construct the foundation piers per Caltrans Standard Plans.

MVDS are proposed at Location 5, 27, 29 and 30. The borings drilled for Locations 5, 27, 29 and 30 encountered groundwater at relatively shallow depths. Groundwater was encountered at 1.5 m below existing grade at Locations 5, 27 and 29, and 3.8 m below existing grade at Location 30. Per the Revised Caltrans Standard Plans (RSP Sheet ES-7A) MVDS with Type 15 TS pole should be supported on a 760 mm diameter Cast-In-Drilled-Hole (CIDH) concrete pile of 1.5 meters long.

It is our opinion that the submerged medium dense sand layers encountered at Locations 27, 29 and 30 might be subject to liquefaction due to strong earthquake. Post-liquefaction settlement maybe expected on the order of 30 mm. Therefore, it is recommended to inform the agency that maintenance may be expected after strong seismic events.

- **CMS**

Location 1 (I-580, KP 35.1)

A full cantilever CMS structure and model 500 sign panel is proposed at Location 1, located on the south side of eastbound I-580, approximately 1 km west of Foothill Road. Based on the boring (P-1) drilled in the vicinity of the proposed CMS, the subsoils generally consist of fill material, which is classified as very stiff to hard sandy lean clay. Groundwater was not encountered during field exploration.

Based on the Caltrans Sign Reference Sheets (P.29), the proposed CMS should be supported on a 1524 mm diameter CIDH concrete pile, and the pile length should not be less than 6.71 m long. Lateral pile capacity was evaluated by using "LPile" program with the design loads per the reference sheet for the proposed 1524 mm diameter CIDH concrete pile of 6.71 m long. The pile

head deflection under the design load is relatively minimal based on the analyses. A copy of the Caltrans Sign Reference Sheet (P. 29) and the LPile analyses is attached in Appendix C.

Location 7 (I-580, KP 25.6)

A full cantilever CMS structure and model 500 sign panel is proposed at Location 7, located on the south side of eastbound I-580, approximately 1.3 km east of Fallon Road. Based on the boring (P-7) drilled in the vicinity of the proposed CMS, the subsoils generally consist of stiff lean clay with medium dense sand from 2.7 to 5.8 m deep. Groundwater was encountered at 7 m deep below the existing grade during field exploration.

Based on the Caltrans Sign Reference Sheets (P.29), the proposed CMS should be supported on a 1524 mm diameter CIDH concrete pile, and the pile length should not be less than 6.71 m long. Lateral pile capacity was evaluated by using "LPile" program with the design loads per the reference sheet for the proposed 1524 mm diameter CIDH concrete pile of 6.71 m long. The anticipated pile head deflection under the design load is on the order of 2.5 mm. A copy of the Caltrans Sign Reference Sheet (P. 29) and the LPile analyses is attached in Appendix C.

Location 11 (I-580, KP 20.3)

A full cantilever CMS structure and model 500 sign panel is proposed at Location 11, located on the north side of westbound I-580, approximately 0.2 km east of Portola Avenue. Based on the borings (PA-4, 2001 and RW-5, 2006) drilled in the vicinity of the proposed CMS, the subsoils generally consist of medium dense sand overlying stiff to very stiff lean clay. Groundwater was encountered at approximately 9.1 m deep below the existing grade during field exploration at Boring PA-4.

Based on the Caltrans Sign Reference Sheets (P.29), the proposed CMS should be supported on a 1524 mm diameter CIDH concrete pile, and the pile length should not be less than 6.71 m long. Lateral pile capacity was evaluated by using "LPile" program with the design loads per the reference sheet for the proposed 1524 mm diameter CIDH concrete pile of 6.71 m long. The anticipated pile head deflection under the design load is on the order of 6 mm. A copy of the Caltrans Sign Reference Sheet (P. 29) and the LPile analyses is attached in Appendix C.

Location 18 (I-680, KP R2.4)

A full cantilever CMS structure and model 500 sign panel is proposed at Location 18, located on the west side of southbound I-680, approximately 0.6 km north of Pine Valley Road. Based on the borings (P-17, 2006) drilled in the vicinity of the proposed CMS, the subsoils generally consist of stiff to hard lean clay. Groundwater was not encountered during field exploration.

Based on the Caltrans Sign Reference Sheets (P.29), the proposed CMS should be supported on a 1524 mm diameter CIDH concrete pile, and the pile length should not be less than 6.71 m long. Lateral pile capacity was evaluated by using "LPile" program with the design loads per the reference sheet for the proposed 1524 mm diameter CIDH concrete pile of 6.71 m long. The pile head deflection under the design load is relatively minimal based on the analyses. A copy of the Caltrans Sign Reference Sheet (P. 29) and the LPile analyses is attached in Appendix C.

Location 20 (I-680, KP R15.6)

A full cantilever CMS structure and model 500 sign panel is proposed at Location 20, located at the southeast corner of the intersection of I-680 and Andrade Road. Based on the boring (P-20, 2006) drilled in the vicinity of the proposed CMS, the subsoils generally consist of stiff lean clay with medium dense sand from 2.0 to 5.2 m deep. Groundwater was not encountered during field exploration.

Based on the Caltrans Sign Reference Sheets (P.29), the proposed CMS should be supported on a 1524 mm diameter CIDH concrete pile, and the pile length should not be less than 6.71 m long. Lateral pile capacity was evaluated by using "LPile" program with the design loads per the reference sheet for the proposed 1524 mm diameter CIDH concrete pile of 6.71 m long. The anticipated pile head deflection under the design load is on the order of 5 mm. A copy of the Caltrans Sign Reference Sheet (P. 29) and the LPile analyses is attached in Appendix C.

Caltrans standard specifications for "Cast-In-Place Concrete Piling" should be followed. Where sand and gravel layers are present, localized raveling or caving may be expected. Temporary casing, additional drilling and cleaning effort, which may increase the concrete volume for the piles, may be anticipated. Groundwater was encountered in some of the borings drilled for the sign structures. It is prudent to make the contractor aware of these conditions so that he takes appropriate steps to comply with the standards and maintain the integrity of the CIDH piles. All pile excavations should be observed by the geotechnical engineer or regulatory agency prior to the placement of the reinforcement and concrete so that if conditions differ from those anticipated, appropriate recommendations can be made.

Plan Review

We recommend that final plans for foundations be reviewed by this office prior to construction so that the intent of our recommendations is included in the project plans and specifications and to further see that no misunderstandings or misinterpretations have occurred.

Limitation

Please be advised that we are performing a professional service and that our conclusions are professional opinions only. All work done and all recommendations made are in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work. We appreciate the opportunity to be of service to you on this project. If there are any questions, please feel free to contact this office.

Respectfully Submitted,
PARIKH CONSULTANTS, INC.

Frank Y. Wang, P.E., C67751
Project Engineer

Gary Parikh, P.E., G.E. 666
Project Manager

REGISTERED PROFESSIONAL ENGINEER
GAURANG R. PARIKH
No. 666
EXP. 12-31-07
GEOTECHNICAL
STATE OF CALIFORNIA

Attachments: Title and Location Map
Caltrans Sign Reference Sheet (P. 29)
LPILE Analyses (6.71 m long, 1524 mm diameter CIDH)

fyw/ydw/gp {S:\Ongoing Project\2005\205140.GDR\ TOS memo.doc}

INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our site reconnaissance and the assumption that the subsurface conditions do not deviate from observed conditions. All work done is in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings. The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed project as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our conclusions and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

The findings in this report are valid as of the present date. However, changes in the subsurface conditions can occur with the passage of time, whether they be due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Sheet No.	Description
1	Title and Location Map
2	Key Map
X	Layouts
X	Construction Details
X	Water Pollution Control Plans and Details
X	Erosion Control Plans
X	Utility Plans
X	Traffic Handling Plans
X	Detour Plans
X	Construction Area Signs
X	Summary of Quantities
X	Electrical Plans
X	Transit Signal Priority
X	Revised Standard Plans

CONGESTION MANAGEMENT AGENCY

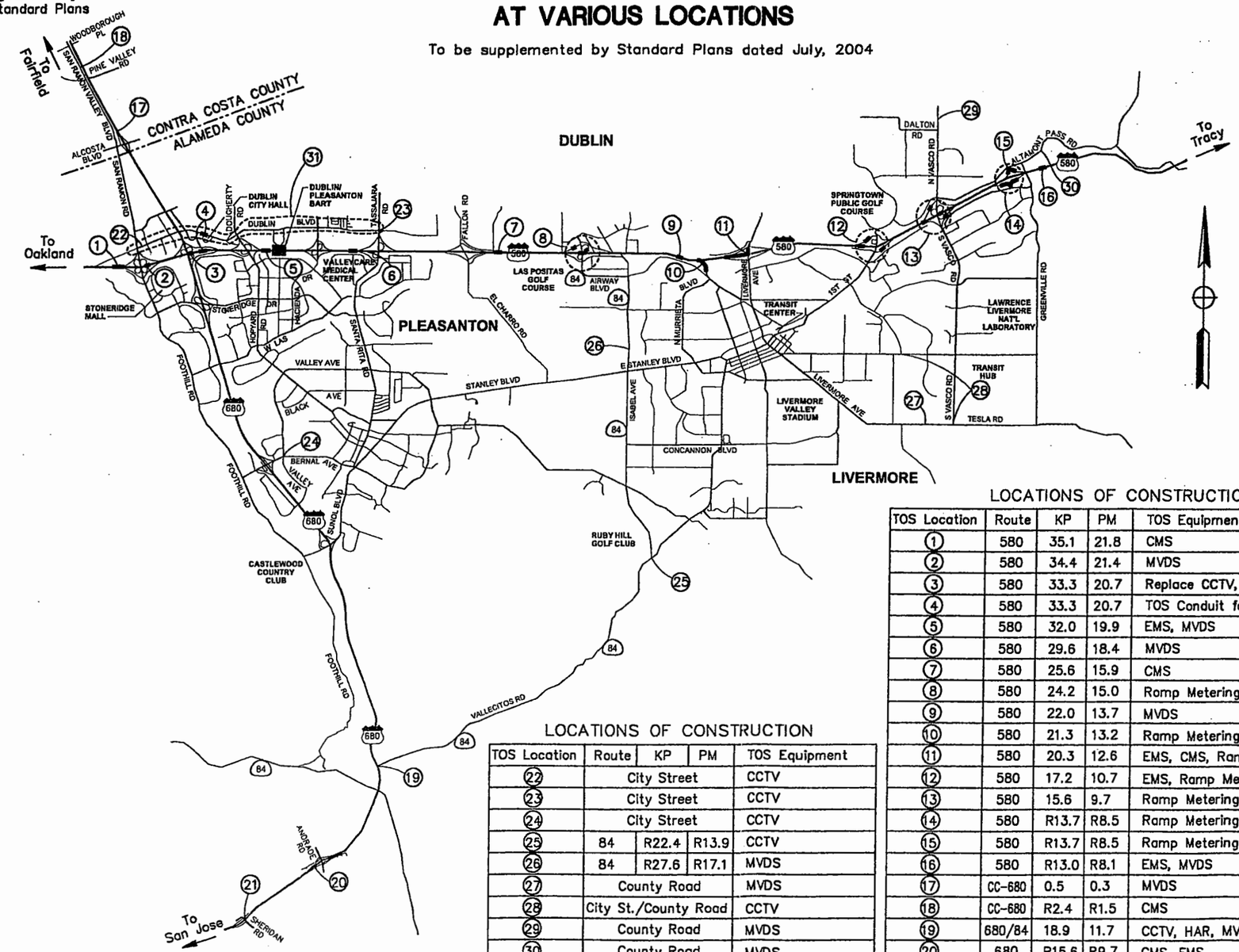
PROJECT PLANS FOR CONSTRUCTION ON

STATE HIGHWAY, COUNTY ROAD, AND CITY STREET

IN ALAMEDA AND CONTRA COSTA COUNTIES AT VARIOUS LOCATIONS

To be supplemented by Standard Plans dated July, 2004

Metric



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NOT FOR CONSTRUCTION

Approved as to impact on State facilities and conformance with applicable State standards and practices and that technical oversight was performed as described in the California Department of Transportation, A & E Consultant Service Manual.

PROJECT ENGINEER | DESIGN OVERSIGHT APPROVAL | PRINTED NAME: | SIGNATURE: | REGISTRATION NO. | DATE

The Contractor shall possess the Class (or classes) of license as specified in the "Notice to Contractors".

LOCATIONS OF CONSTRUCTION

TOS Location	Route	KP	PM	TOS Equipment
22	City Street			CCTV
23	City Street			CCTV
24	City Street			CCTV
25	84	R22.4	R13.9	CCTV
26	84	R27.6	R17.1	MVDS
27	County Road			MVDS
28	City St./County Road			CCTV
29	County Road			MVDS
30	County Road			MVDS
31	City Street			Interconnect

LOCATIONS OF CONSTRUCTION

TOS Location	Route	KP	PM	TOS Equipment
1	580	35.1	21.8	CMS
2	580	34.4	21.4	MVDS
3	580	33.3	20.7	Replace CCTV, CCTV
4	580	33.3	20.7	TOS Conduit for City of Dublin
5	580	32.0	19.9	EMS, MVDS
6	580	29.6	18.4	MVDS
7	580	25.6	15.9	CMS
8	580	24.2	15.0	Romp Metering, CCTV
9	580	22.0	13.7	MVDS
10	580	21.3	13.2	Ramp Metering
11	580	20.3	12.6	EMS, CMS, Ramp Metering
12	580	17.2	10.7	EMS, Ramp Metering, HAR, CCTV
13	580	15.6	9.7	Ramp Metering
14	580	R13.7	R8.5	Ramp Metering
15	580	R13.7	R8.5	Ramp Metering, CCTV
16	580	R13.0	R8.1	EMS, MVDS
17	CC-680	0.5	0.3	MVDS
18	CC-680	R2.4	R1.5	CMS
19	680/84	18.9	11.7	CCTV, HAR, MVDS
20	680	R15.6	R9.7	CMS, EMS
21	680	13.0	8.1	NONE

Approved as to Feature affecting County of Alameda Facilities — Date

Approved as to Feature affecting City of Dublin Facilities — Date

Approved as to Feature affecting City of Livermore Facilities — Date

Approved as to Feature affecting City of Pleasanton Facilities — Date

Project Manager Registered Civil Engineer — Date

REGISTERED PROFESSIONAL ENGINEER — JAMES T. PUN — No. C35305 — Exp. 9/30/07 — CIVIL — STATE OF CALIFORNIA

Plans Approval Date

ALAMEDA COUNTY CONGESTION MANAGEMENT AGENCY
1333 BROADWAY, SUITE 220
OAKLAND, CA 94612

T Y LIN INTERNATIONAL | CCS
1111 BROADWAY SUITE 2150
OAKLAND, CA 94607

Contract No. 04-3A4504

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LAST REVISION

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3

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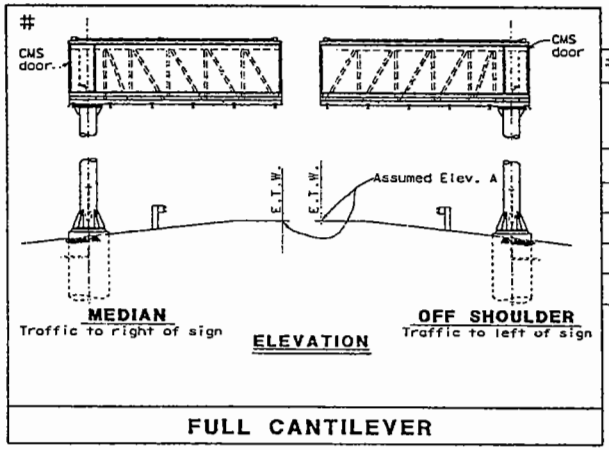
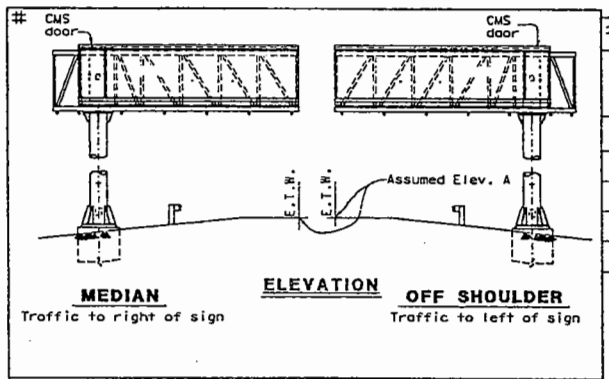
FORM DC-OE-93-PE (REV. 3/98)



FULL CANTILEVER

TABLE Q (QUANTITIES)

"h"(m)	Weight (kg.) walkway 1 side	Weight (kg.) walkway 2 sides
4.9	7310	8099
5.5	7425	8214
6.1	7541	8330
6.7	7657	8446
7.3	7772	8561



UNBALANCED BUTTERFLY

TABLE Q (QUANTITIES)

"h"(m)	Weight (kg) walkway 1 side	Weight (kg) walkway 2 sides
4.9	7523	8351
5.5	7639	8466
6.1	7755	8582
6.7	7870	8698
7.3	7986	8813

PRELIMINARY NOTES

FOUNDATION DESIGN

Foundation design is based on 2001 AASHTO article 13.6 Brams' approximate procedure assuming a cohesionless material. The angel of internal friction used is 30 degree and unit weight of soil used is 1922 kg/m3

Foundation review and foundation recommendations for pile length are required. Pile length can not be less than 6.71m

Review shall included alternative foundation types where CIDH pile foundation is not recommended. Project Plans and Structure Details may need revisions per foundation recommendations.

Caltrans Metric

DIST | COUNTY | ROUTE | KILOMETER POST TOTAL PROJECT | SHEET TOTAL NO SHEETS

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER — No. — CIVIL — STATE OF CALIFORNIA

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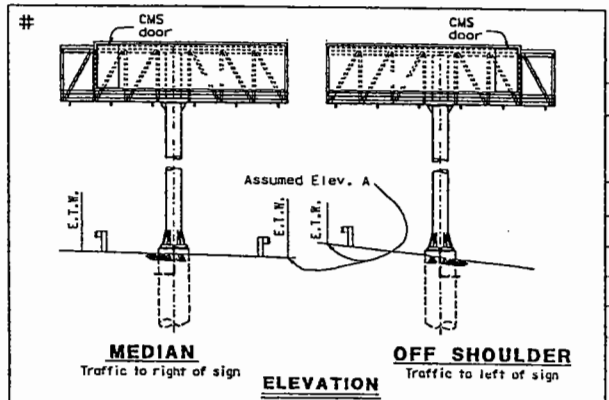
Not to be included in contract documents.

 # Instructions for using this sheet:

1. Read "PRELIMINARY NOTES" above.
2. Choose the type of CMS desired, and place this information in "Table 1" under the heading "CMS Type".
3. Determine the "h" value based on site information, and enter that value in "Table 1" under the heading "h".
4. Find the "h" value in "TABLE Q" of the type of CMS you are using and find the quantity given in either the "1 side" or "2 sides" column, and enter this value in"Table 1" under the "Furnish" heading and the "Install" heading. Indicate on this sheet if you are using walkways on 1 side or two sides of truss by choosing the appropriate note "1".
5. Continue to fill in "Table 1" with the appropriate corresponding values for CMS you are using.

Model 500 Reactions

Axial (kN)	Shear (kN)	Bending Moment (kN-m)
75	61	493



BALANCED BUTTERFLY

TABLE Q (QUANTITIES)

"h"(m)	Weight (kg.) walkway 1 side	Weight (kg.) walkway 2 sides
4.9	7550	8354
5.5	7627	8431
6.1	7743	8547
6.7	7859	8663
7.3	7974	8778

TABLE 1

CMS Type	Loc No.	Station	Route	Orientation	X (m)	"h"(m)	Assumed Elev A (m)	** Elev B(m)	QUANTITIES Furnish (kg)	Install (kg)	1524 mm Dia CIDH Pile (m)
							100.00		See TABLE Q	See TABLE Q	*

* see data from foundation recommendations

** Assumed Elev. B is at bottom of Base plate

NOTES:

1. Quantities are based on either 1-side or 2-sides walkway.
2. For layout and dimensions see "LAYOUT" sheet.
3. Quantities do not include "State furnished CMS Panel".
4. The contractor shall verify all controlling field dimensions before ordering or fabricating any material.

SIGN PLAN
MODEL 500
CHANGEABLE MESSAGE SIGNS
OVERHEAD SIGN TRUSS SINGLE POST
DESIGN TABLE

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04-24-06 TIME PLOTTED = 17:11

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DGN FILE = ant29.dgn

CU | EA

LOCATION 1

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I-580 TOS, LOCATION 1, CMS
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0       60      318086.26       2827.43 3000000
264     60      318086.26       2827.43 3000000
1       2       2       0       0
3       0       264     0       0
0       0.069
264     0.069
0       20.83   0       0.003162        0
264     20.83   0       0.003162        0
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1
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0
1       1       0
100     1E-5    100
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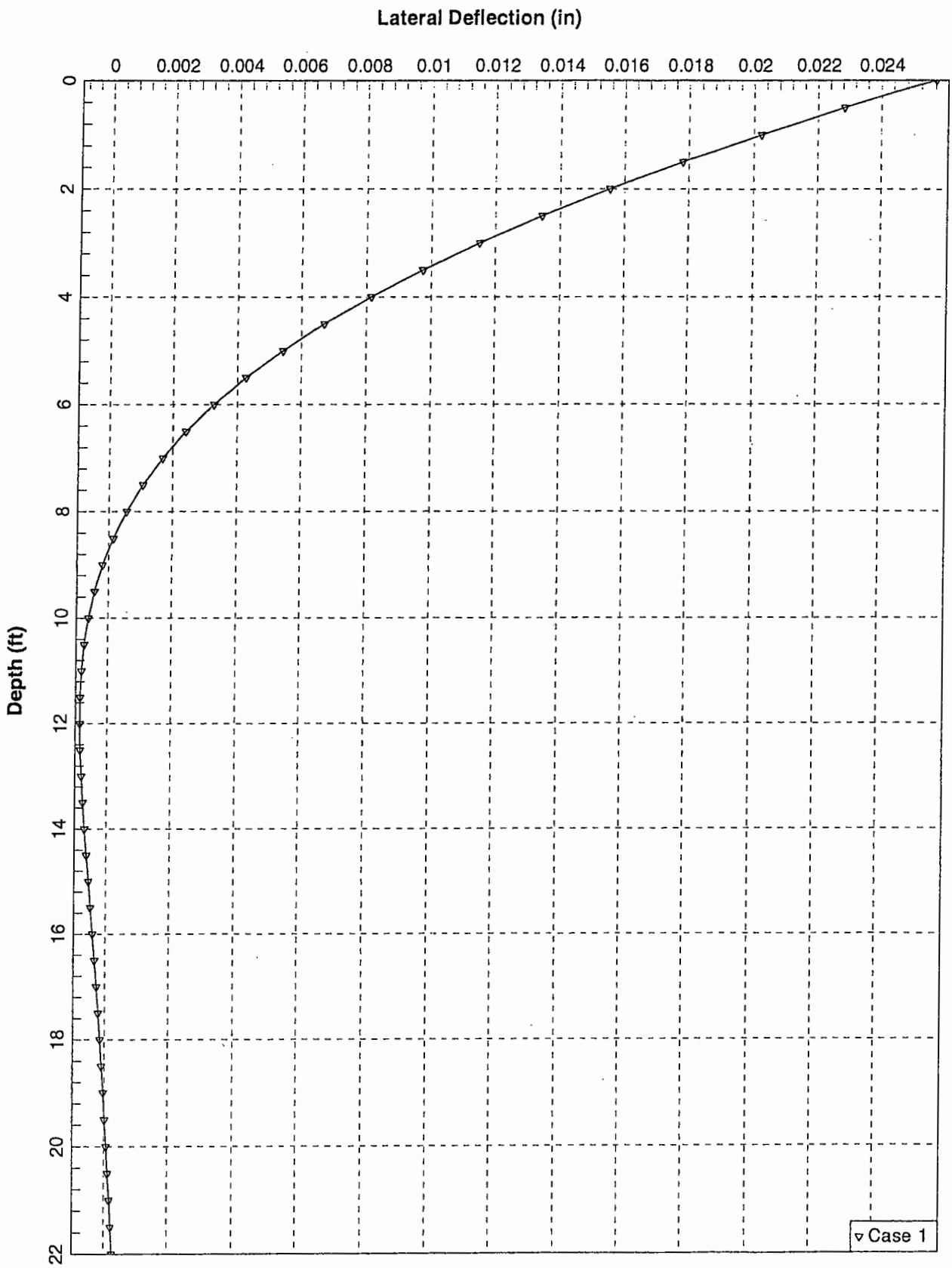
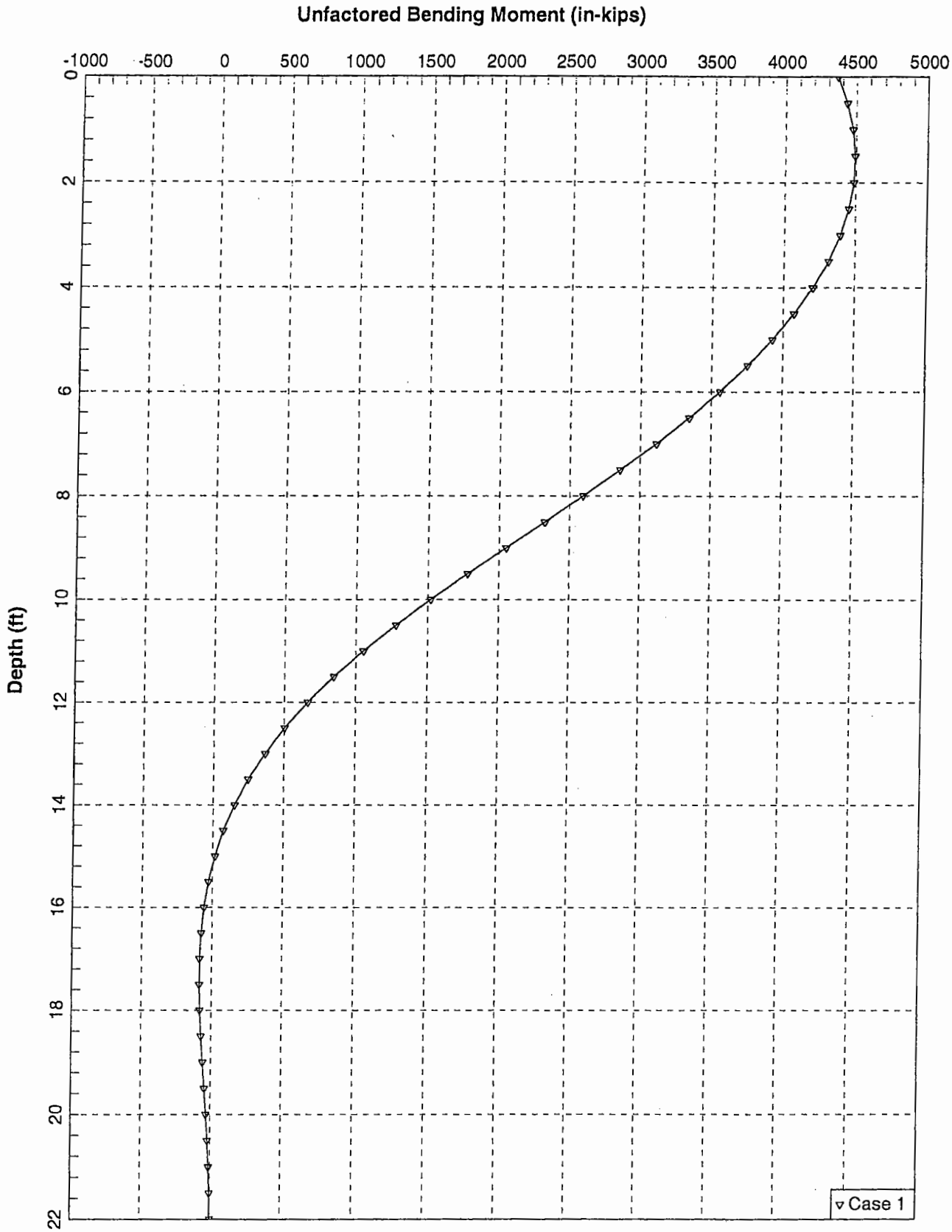
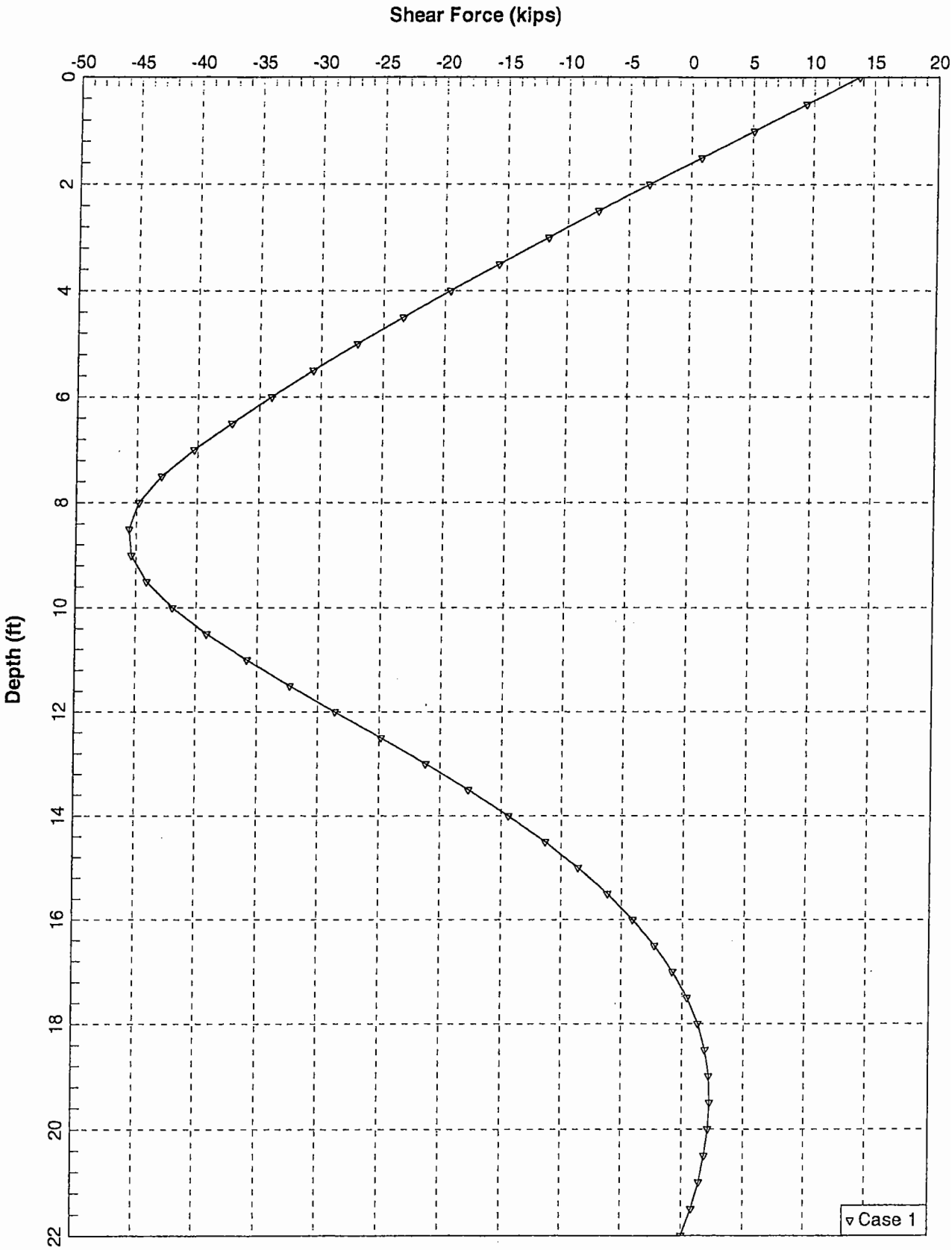


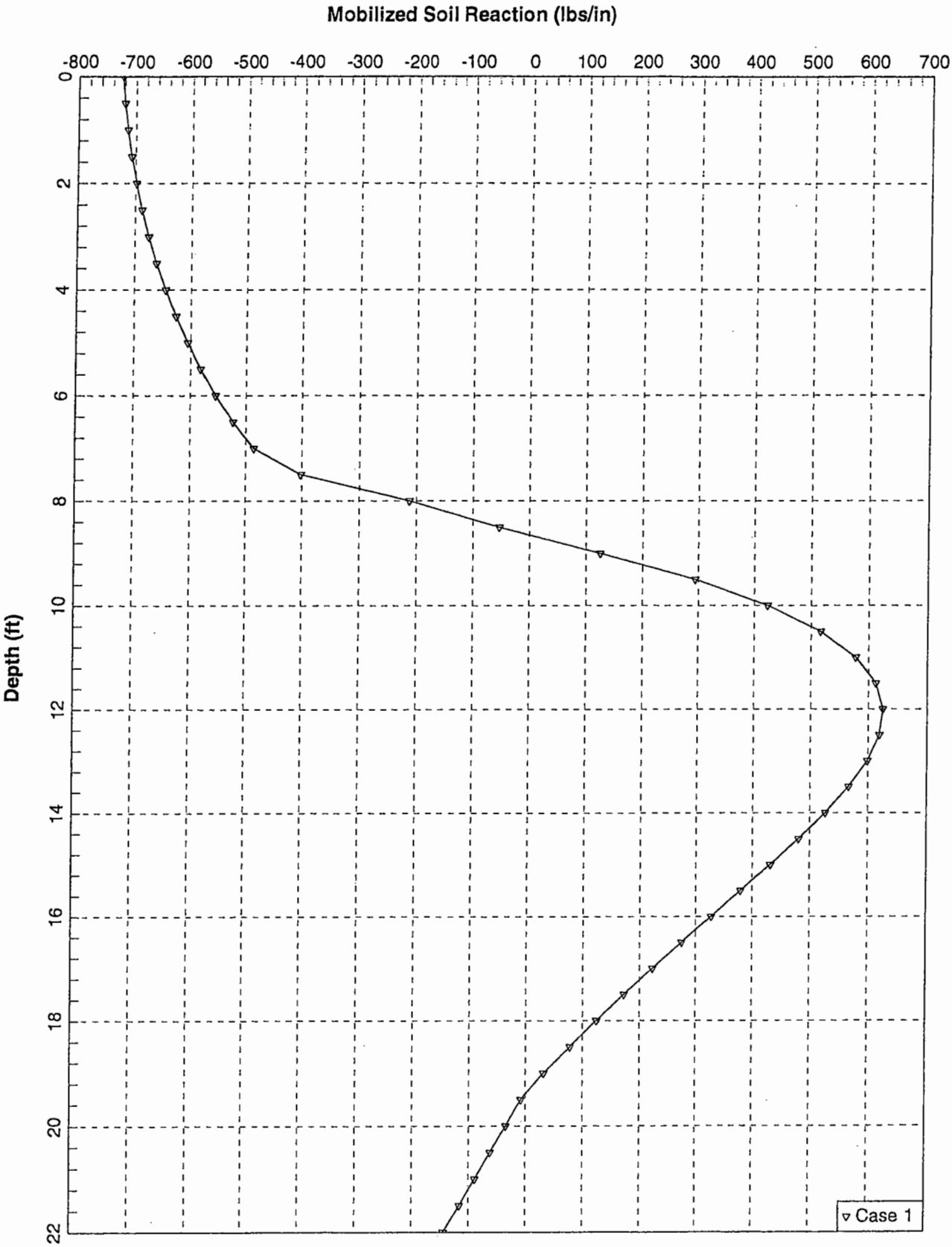
I-580 TOS, CMS, LOCATION 1, 5 FT DIA. CIDH



I-580 TOS, CMS, LOCATION 1, 5 FT DIA. CIDH



I-580 TOS, CMS, LOCATION 1, 5 FT DIA. CIDH



I-580 TOS, CMS, LOCATION 1, 5 FT DIA. CIDH

LOCATION 7

```
LPILEP5
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1       1       0       0       0       0
44      2       0       264     14
0       60      318086.26       2827.43 3000000
264     60      318086.26       2827.43 3000000
3       6       6       0       0
3       0       120     0       0
4       120     240     39.53   39.53
3       240     264     0       0
0       0.069
120     0.069
120     0.069
240     0.069
240     0.035
264     0.035
0       6.94    0       0.004427        0
120     6.94    0       0.004427        0
120     0       30      0       0
240     0       30      0       0
240     10.42   0       0.004427        0
264     10.42   0       0.004427        0
0       1       0
1
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0
1       1       0
100     1E-5    100
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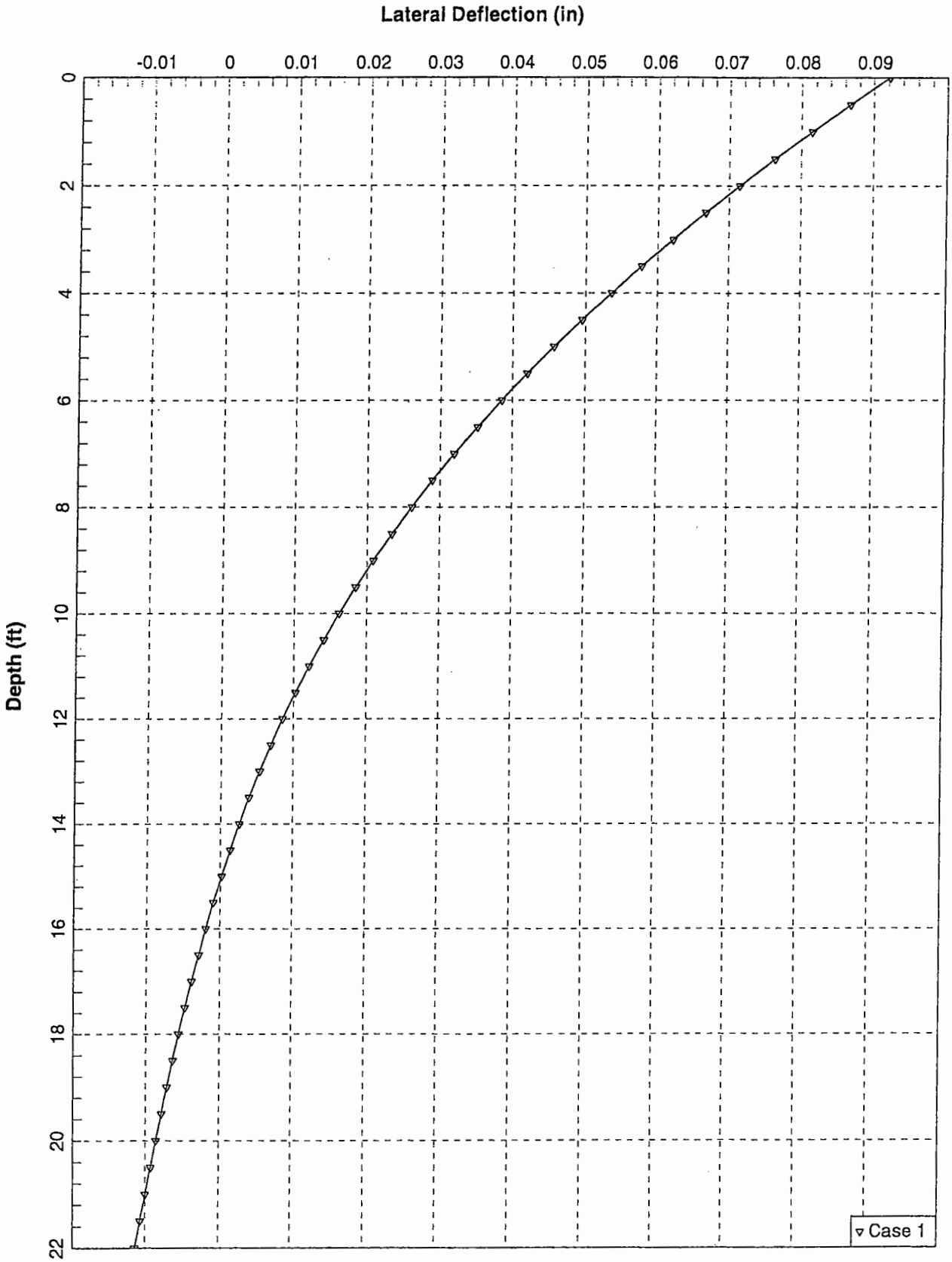
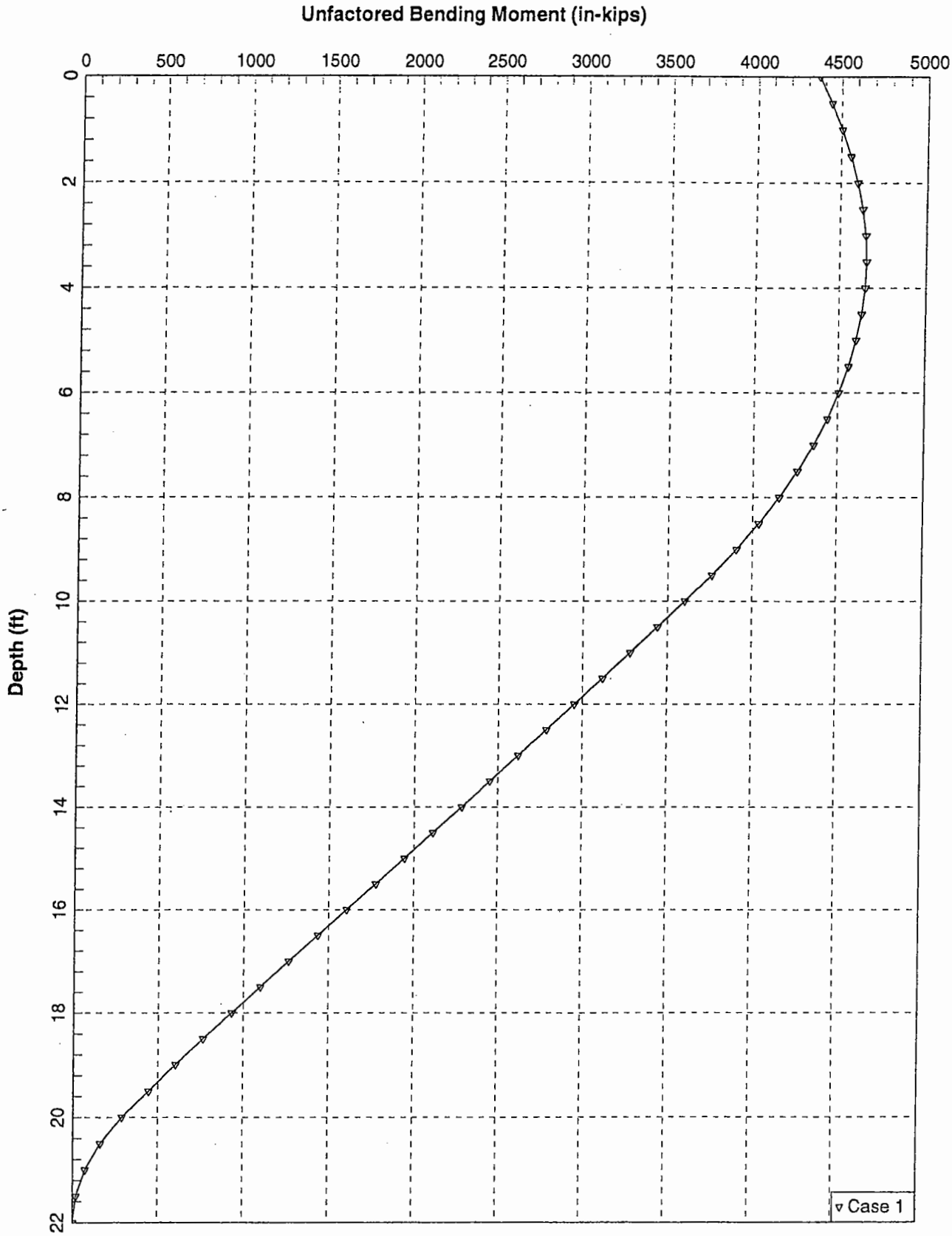
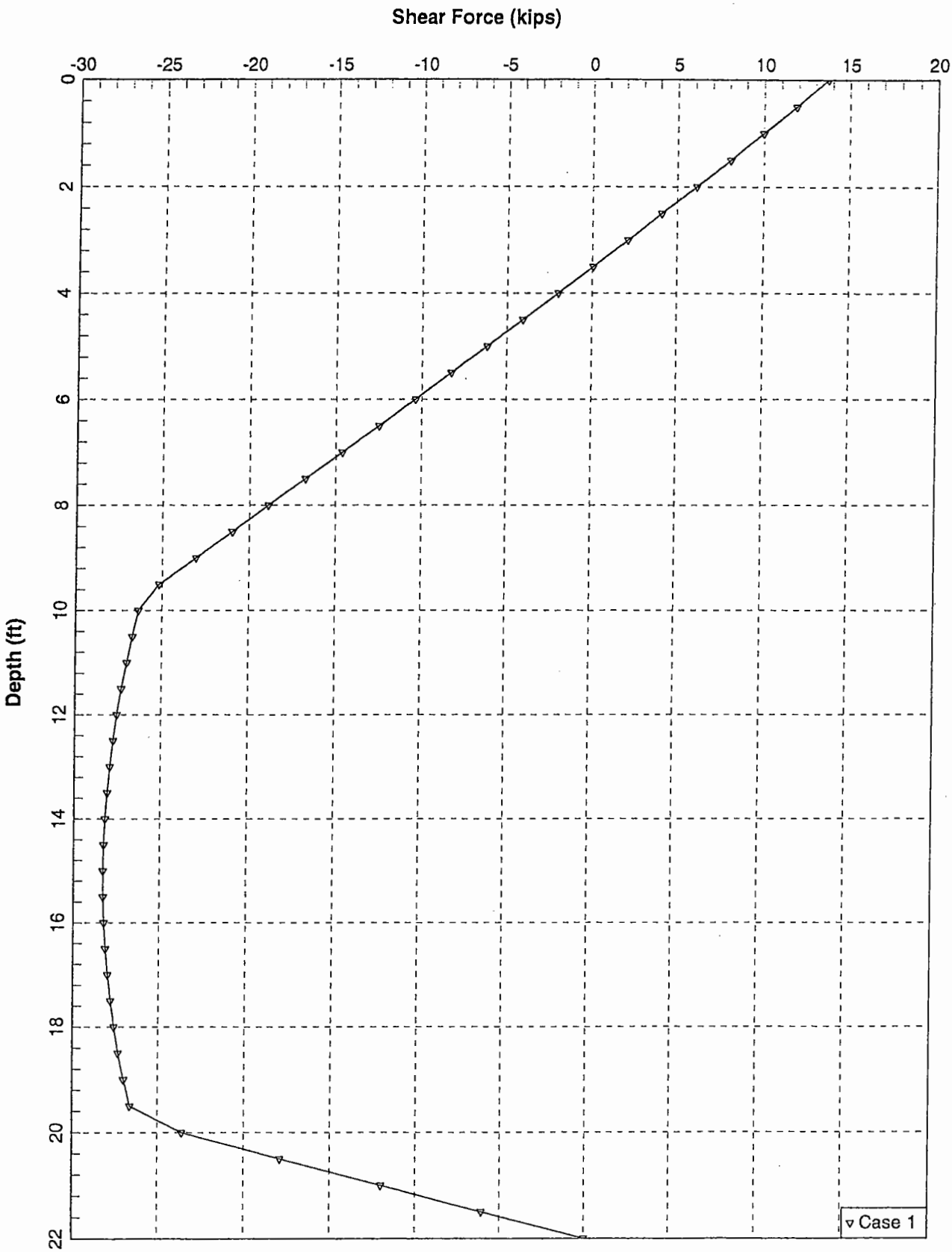


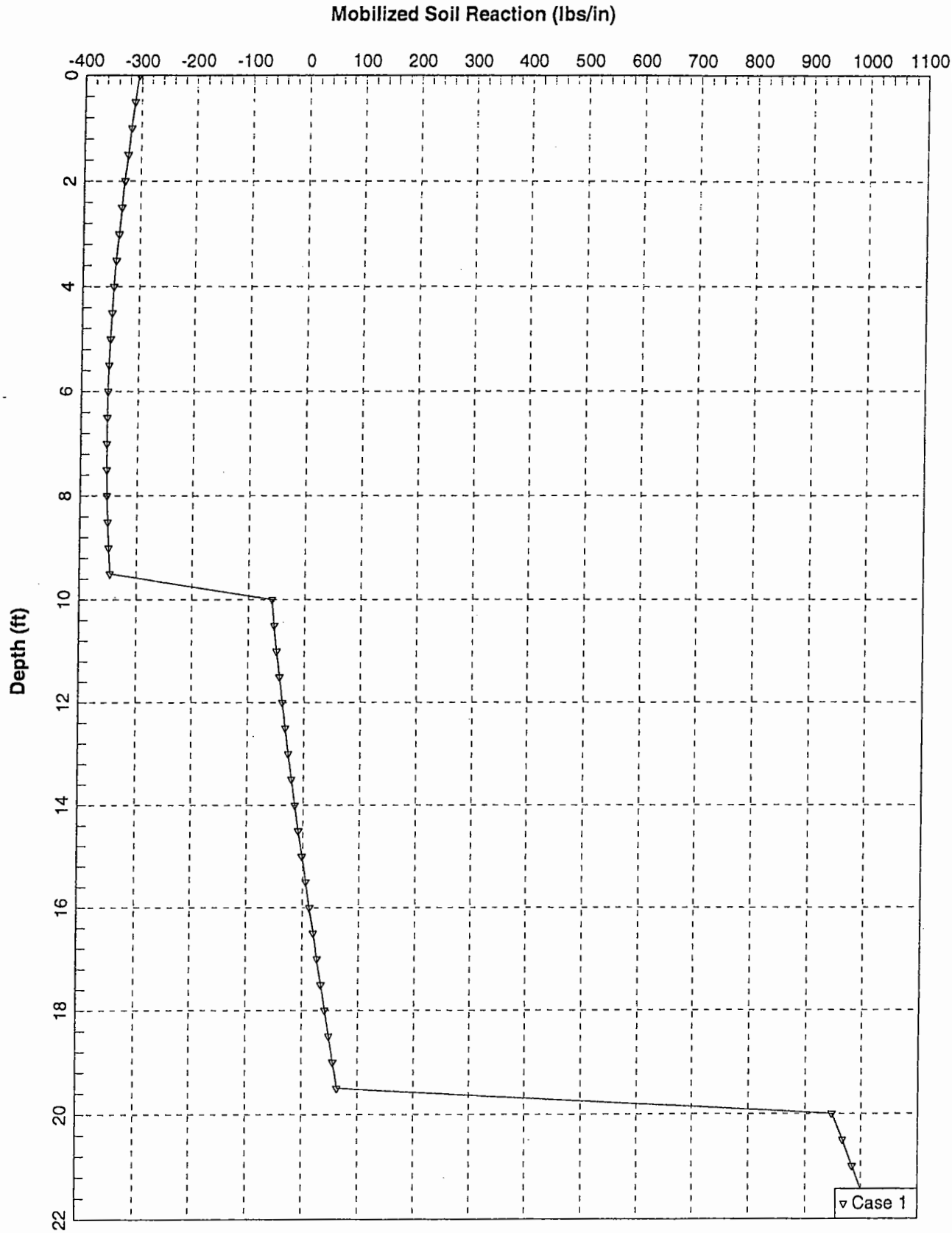
I-580 TOS, CMS, LOCATION 7, 5 FT DIA. CIDH



I-580 TOS, CMS, LOCATION 7, 5 FT DIA. CIDH



I-580 TOS, CMS, LOCATION 7, 5 FT DIA. CIDH



I-580 TOS, CMS, LOCATION 7, 5 FT DIA. CIDH

LOCATION 11

```
LPILEP5
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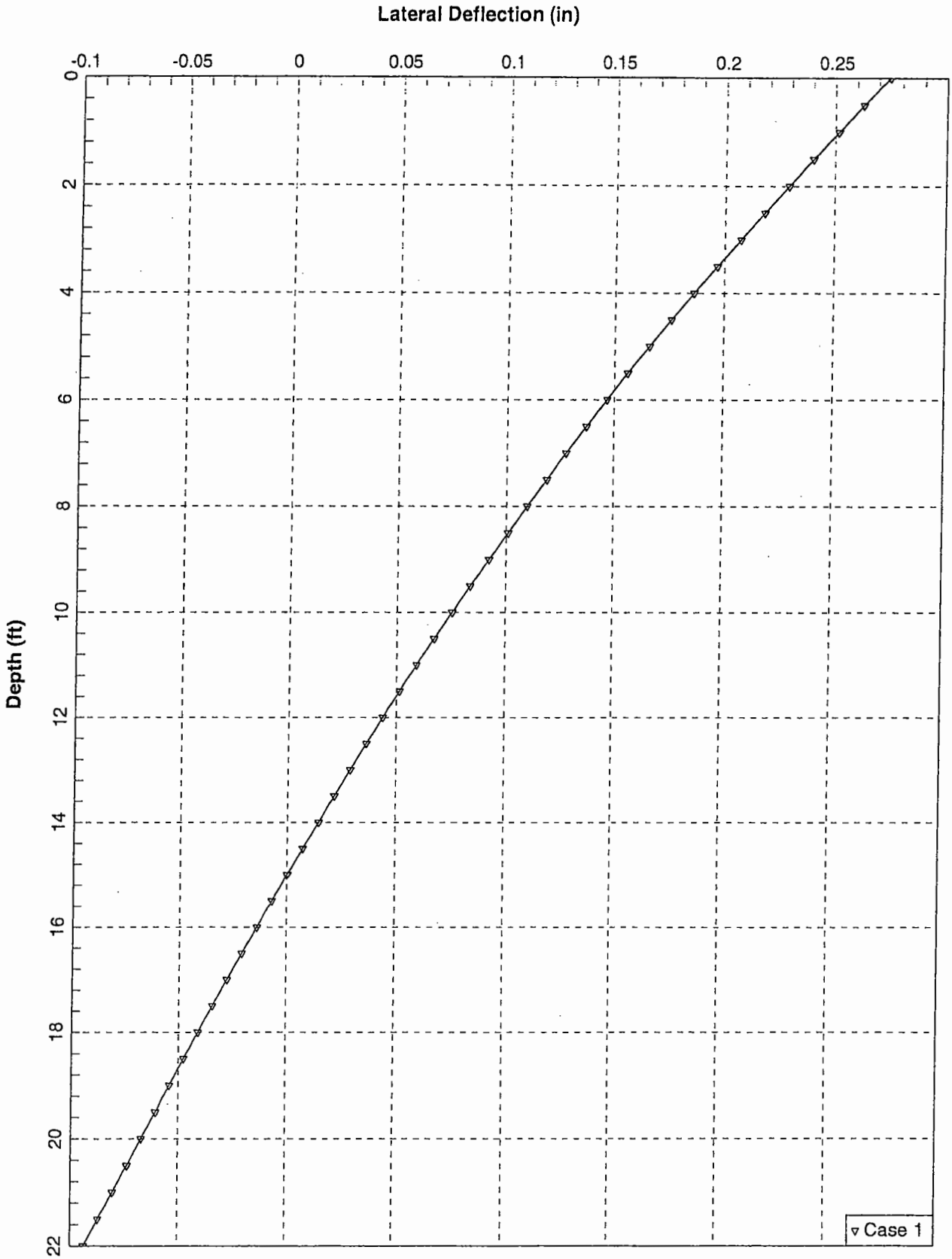
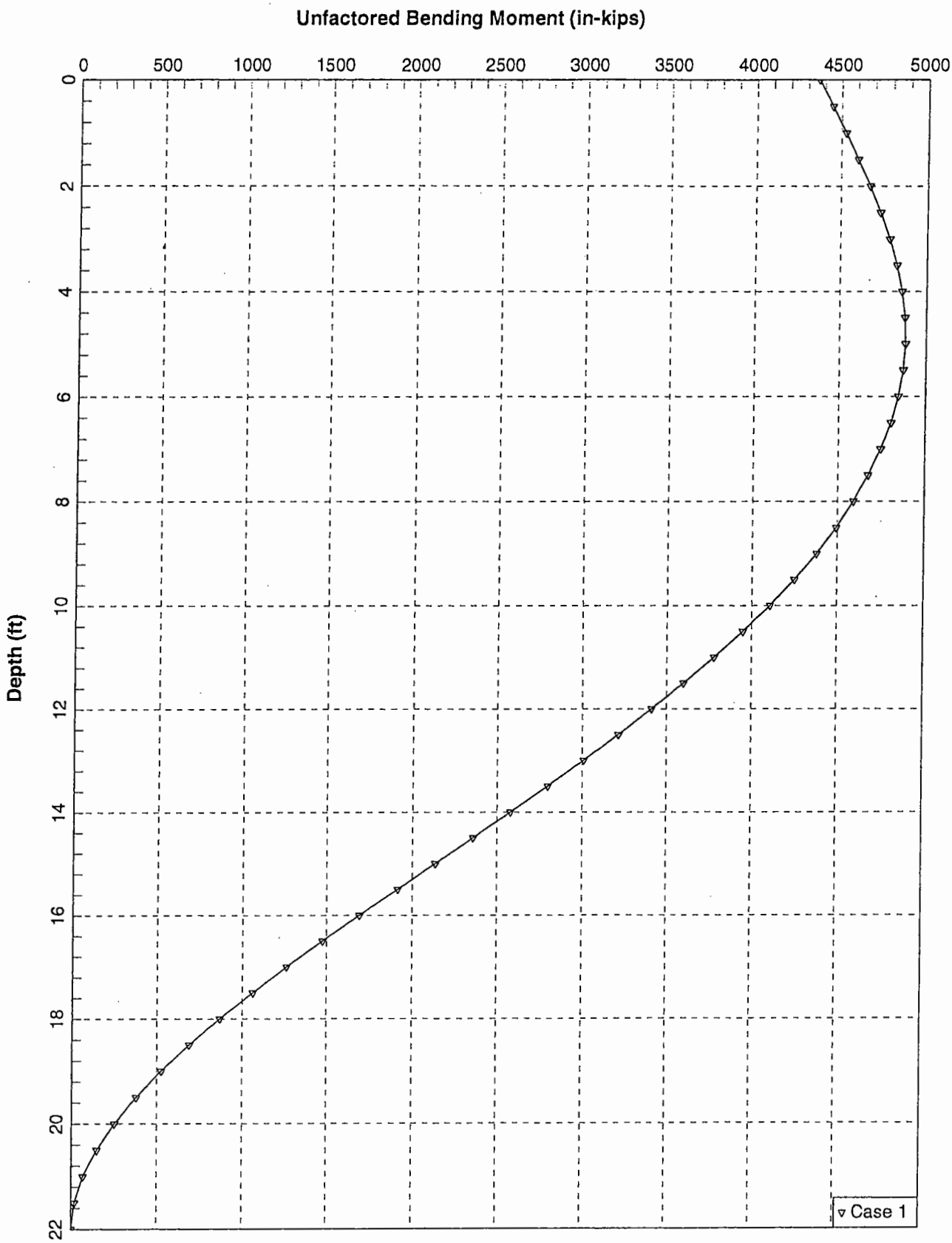
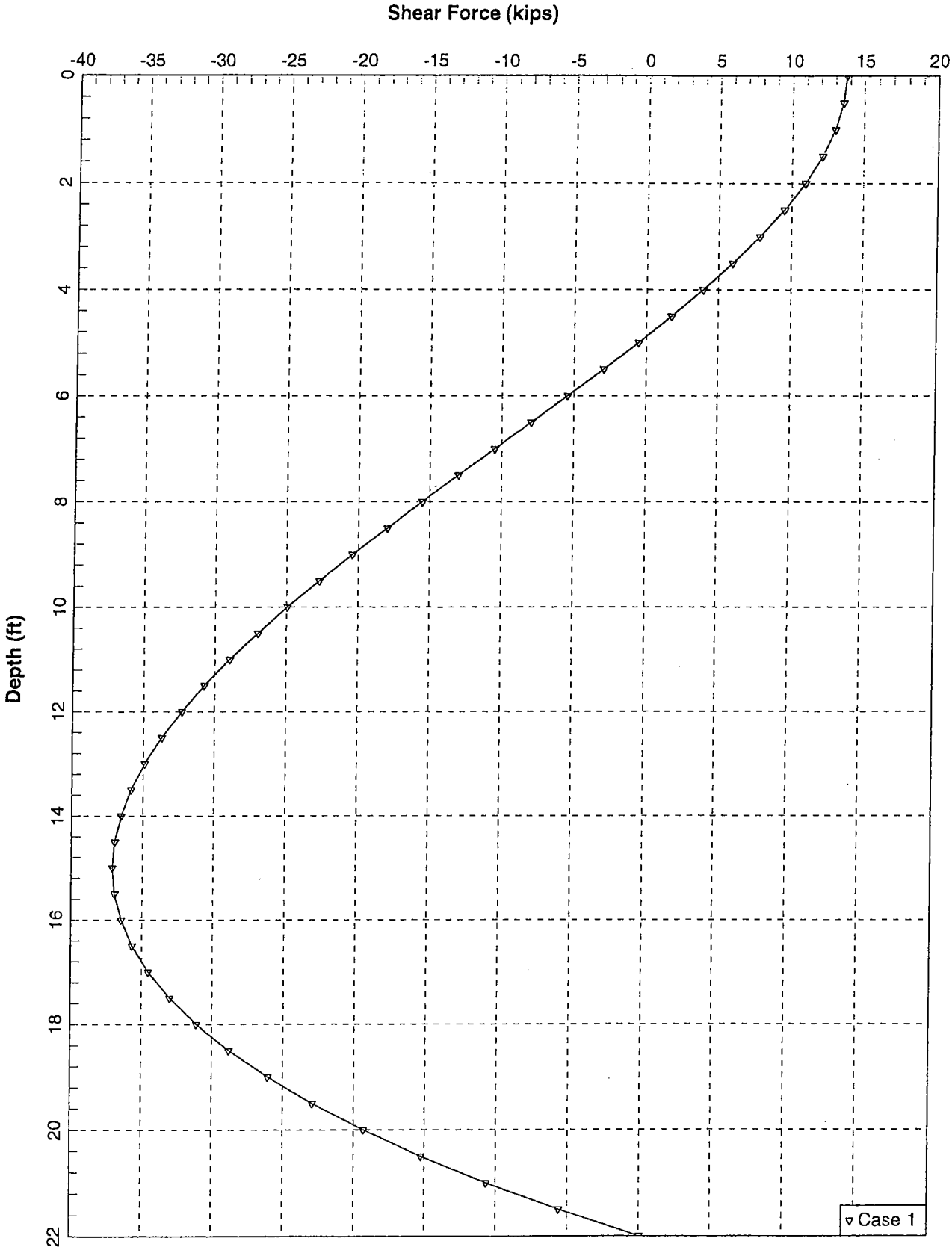
44        2         0         264       14
0         60        318086.26           2827.43   3000000
264       60        318086.26           2827.43   3000000
1         2         2         0         0
4         0         264       39.53     39.53
0         0.072
264       0.072
0         0         32        0         0
264       0         32        0         0
0         1         0
1
1         13713.35            4363418.8           16860.675
0
1         1         0
100       1E-5      100
```



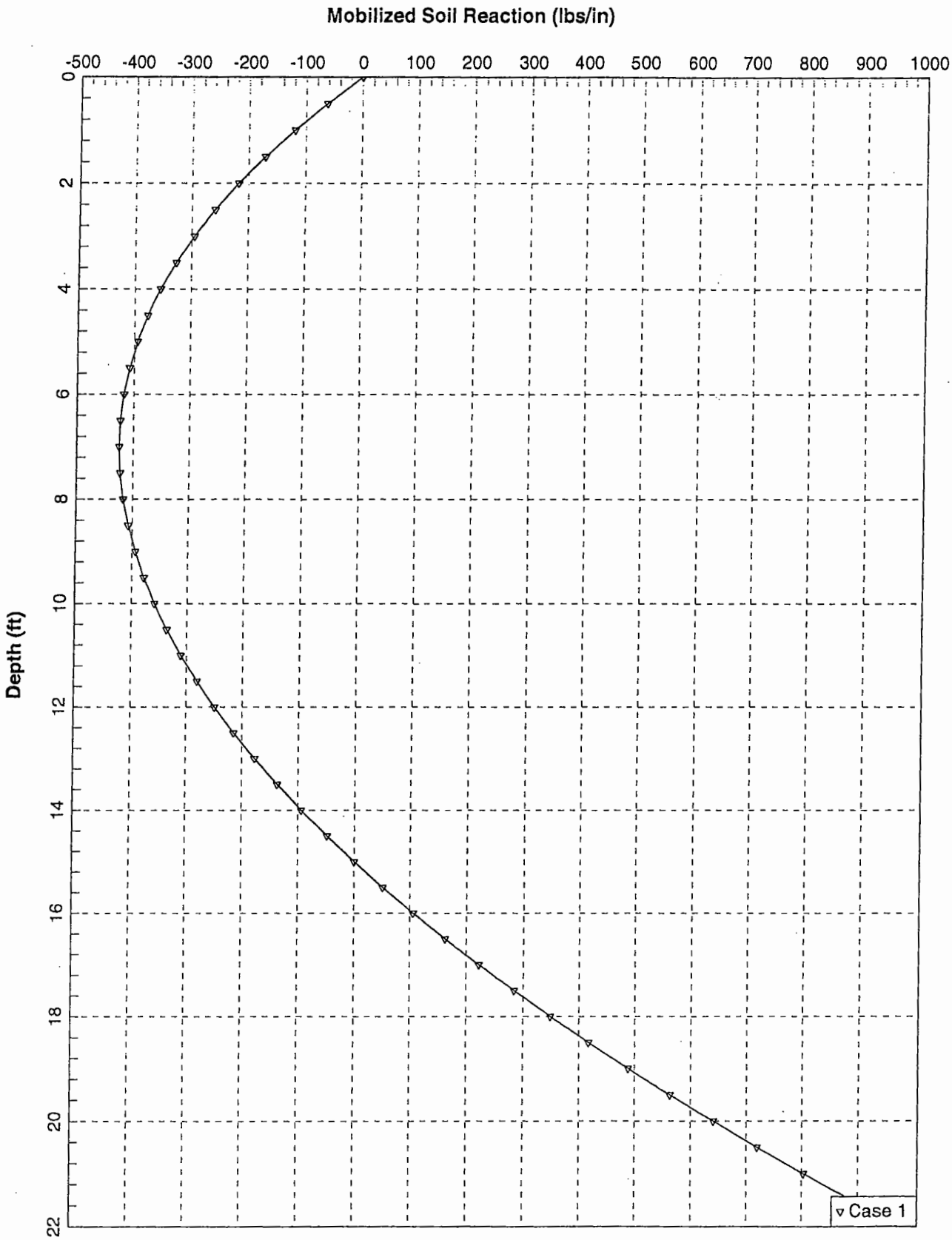
I-580 TOS, CMS, LOCATION 11, 5 FT DIA. CIDH



I-580 TOS, CMS, LOCATION 11, 5 FT DIA. CIDH



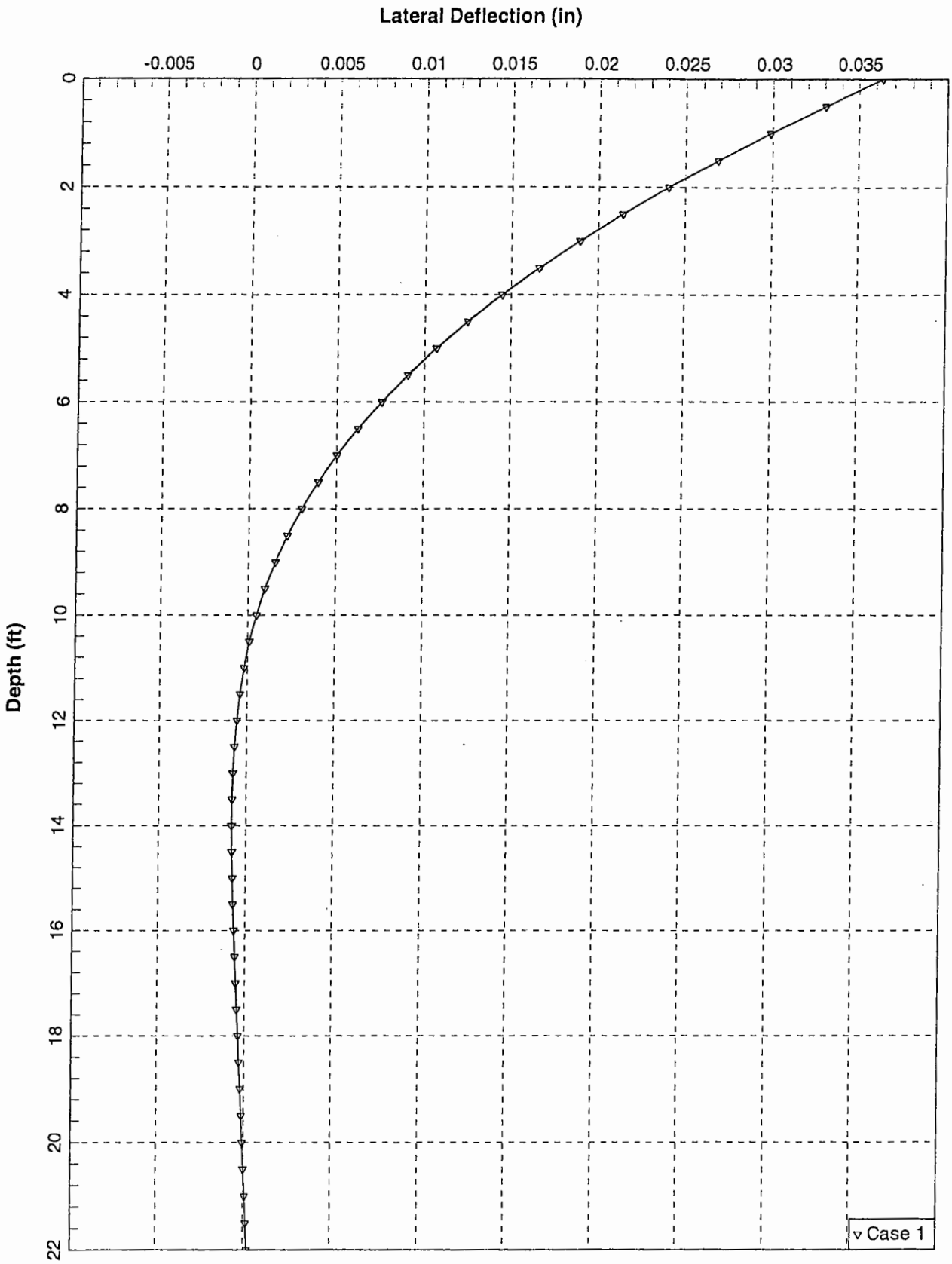
I-580 TOS, CMS, LOCATION 11, 5 FT DIA. CIDH



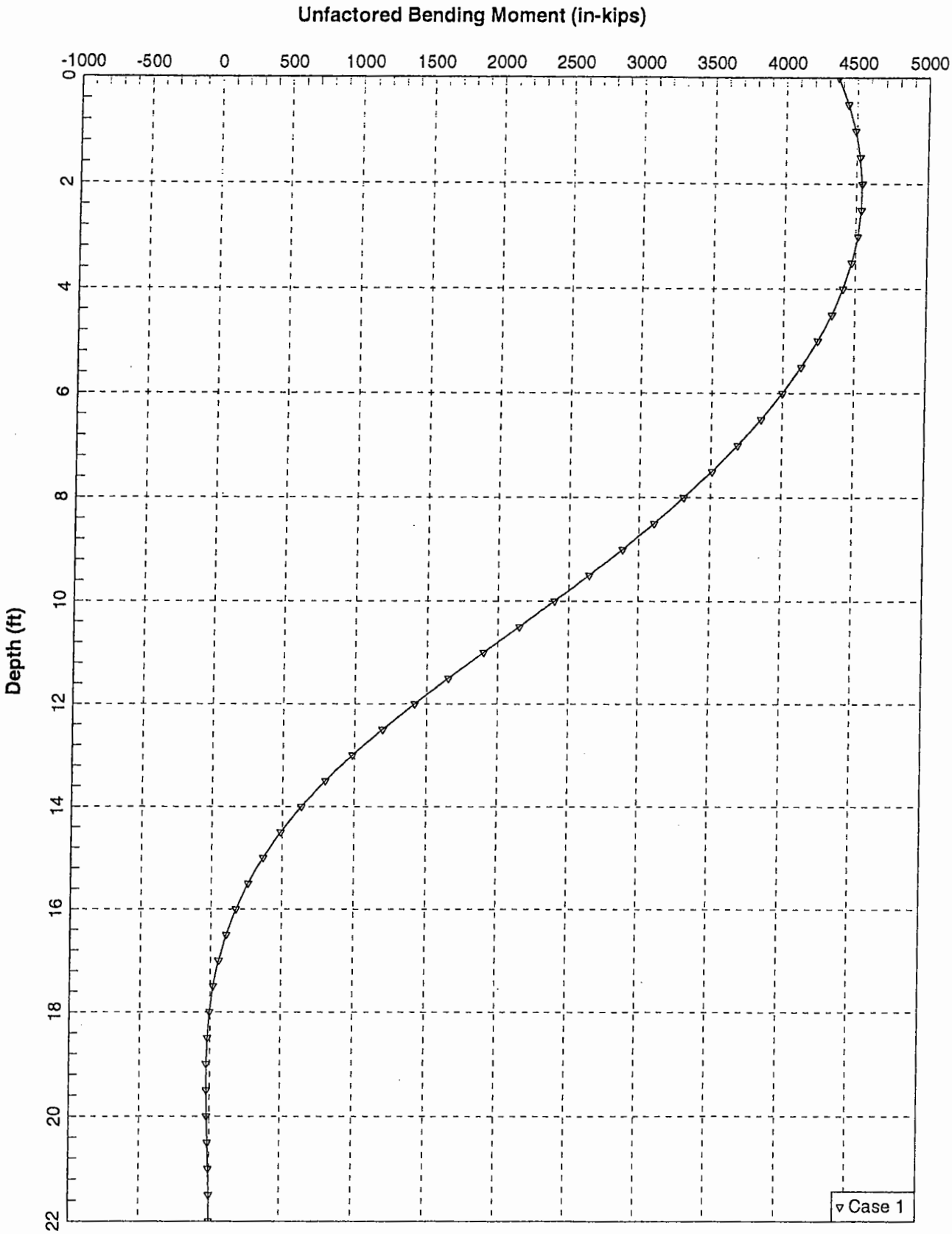
I-580 TOS, CMS, LOCATION 11, 5 FT DIA. CIDH

LOCATION 18

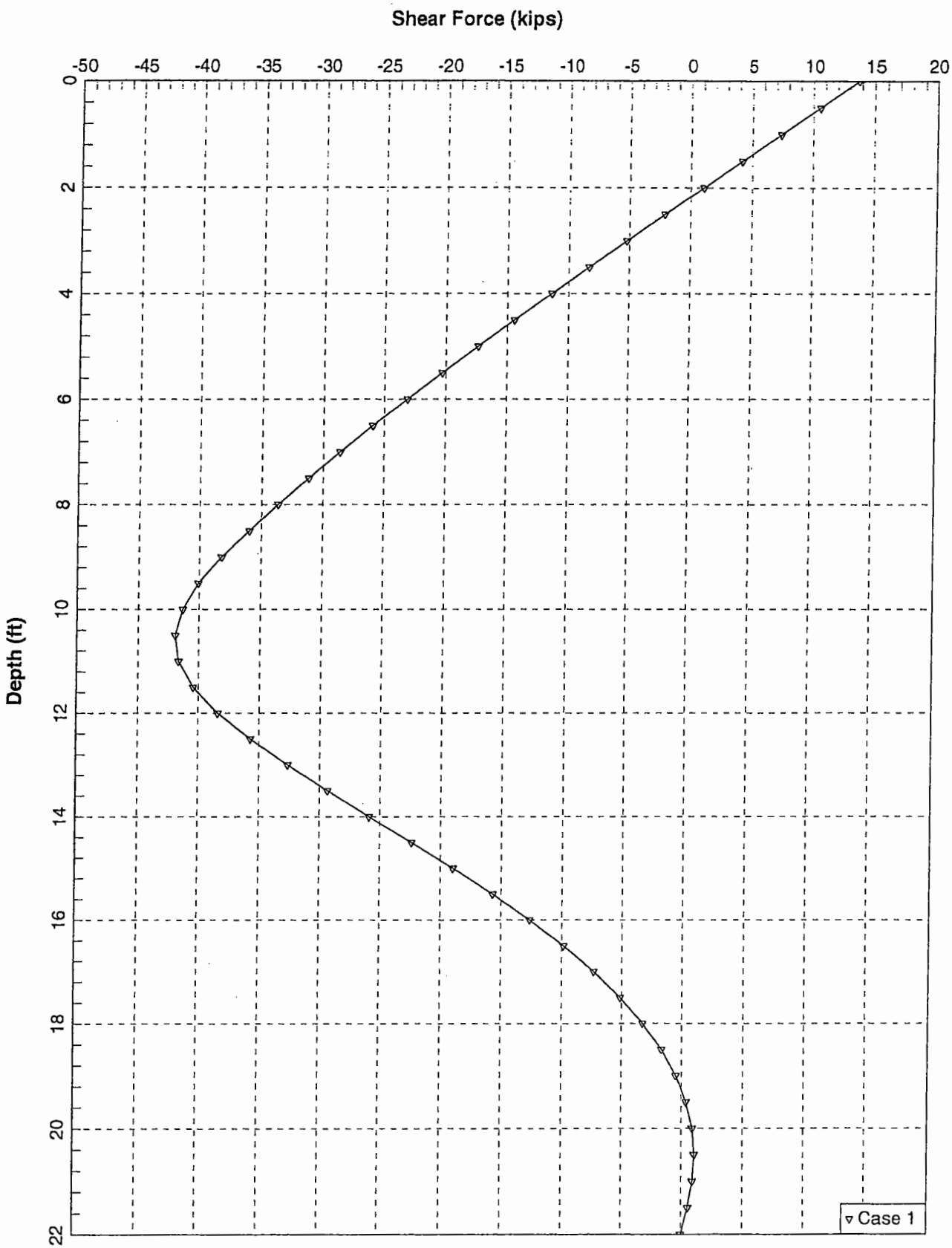
```
LPILEP5
I-580 TOS, LOCATION 1, CMS
1       1       0       0       0       0
44      2       0       264     14
0       60      318086.26       2827.43 3000000
264     60      318086.26       2827.43 3000000
2       4       4       0       0
3       0       120     0       0
3       120     264     0       0
0       0.069
120     0.069
120     0.069
264     0.069
0       13.89   0       0.003162        0
120     13.89   0       0.003162        0
120     20.83   0       0.003162        0
264     20.83   0       0.003162        0
0       1       0
1
1       13713.35        4363418.8       16860.675
0
1       1       0
100     1E-5    100
```



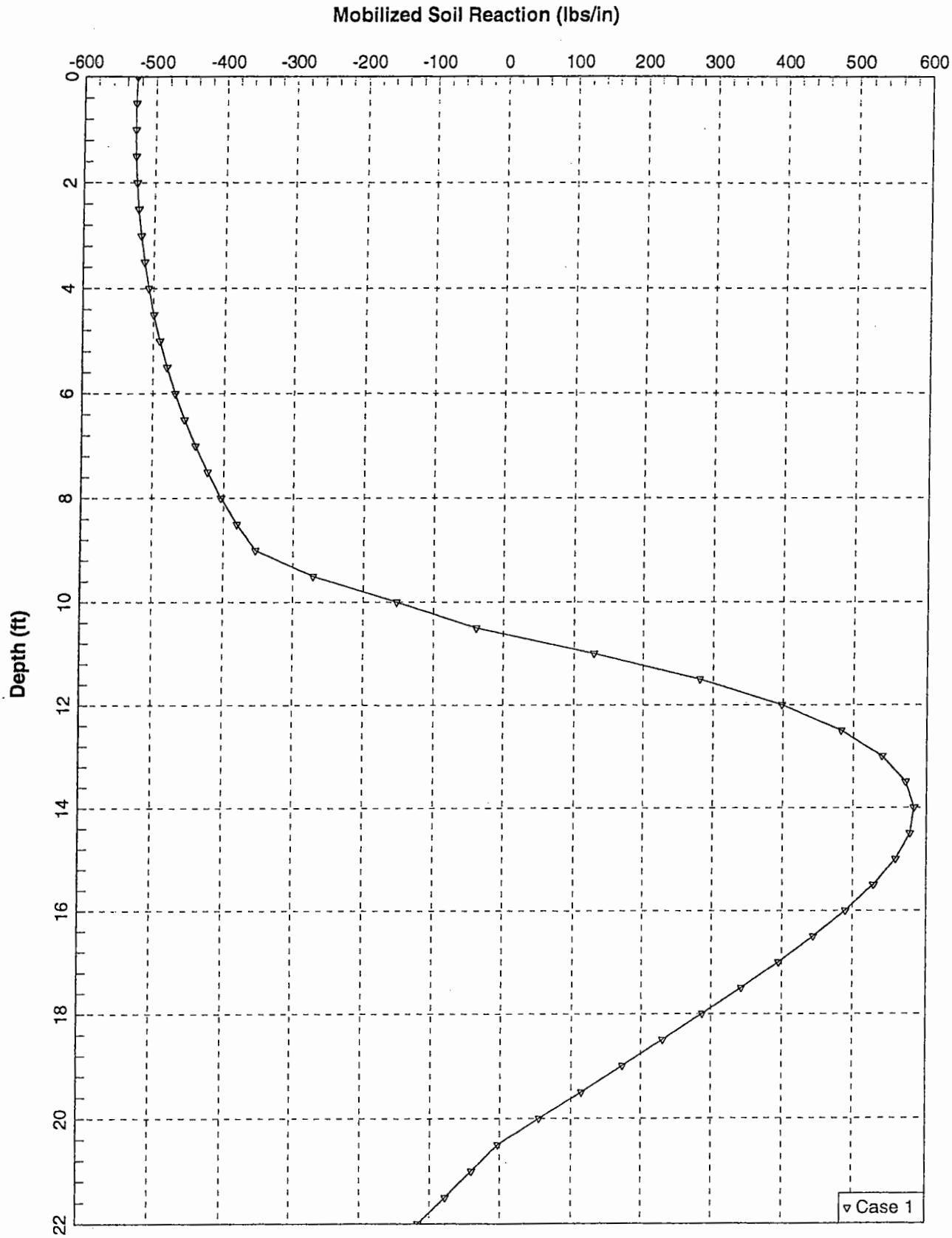
I-580 TOS, CMS, LOCATION 18, 5 FT DIA. CIDH



I-580 TOS, CMS, LOCATION 18, 5 FT DIA. CIDH



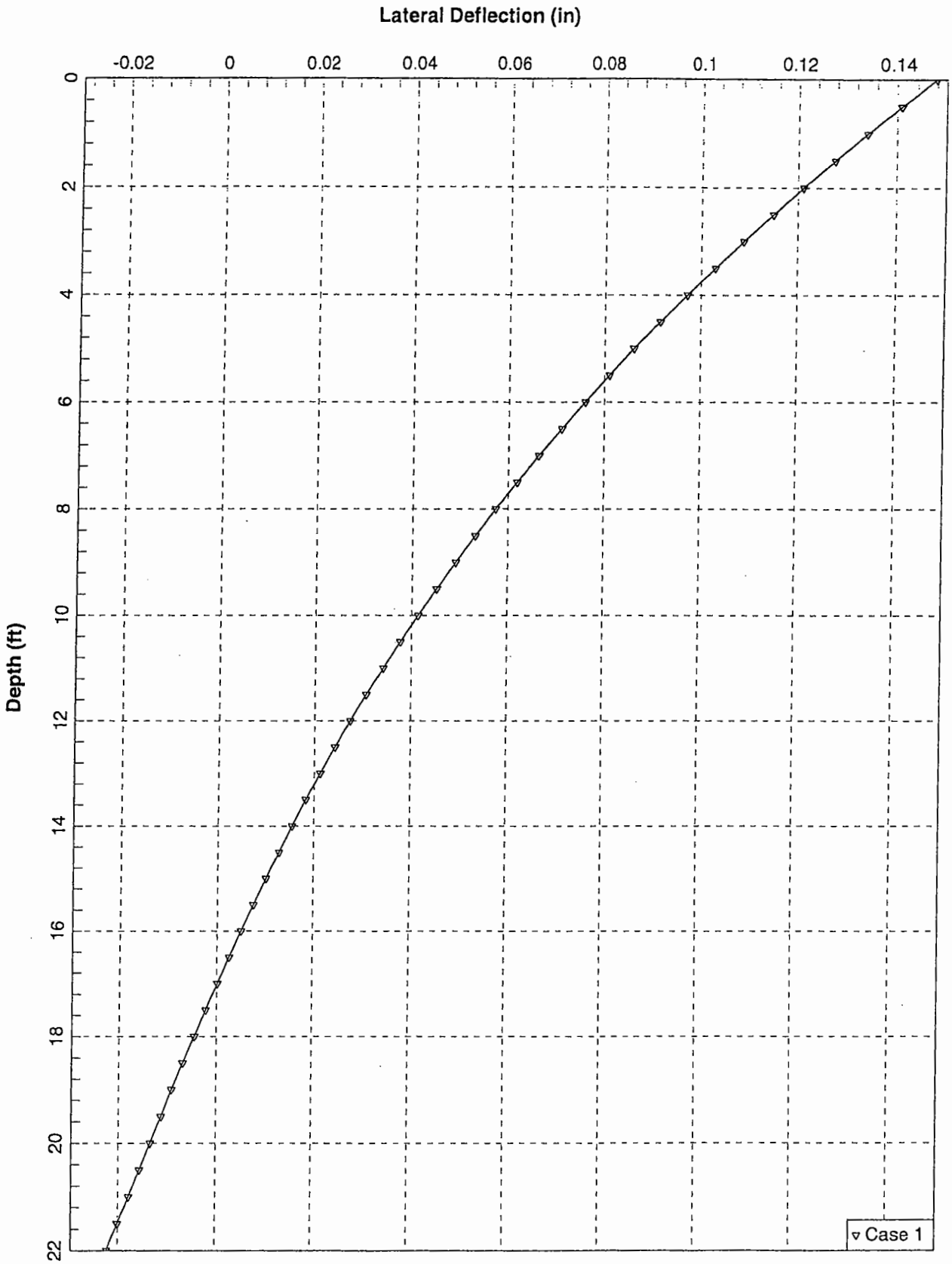
I-580 TOS, CMS, LOCATION 18, 5 FT DIA. CIDH



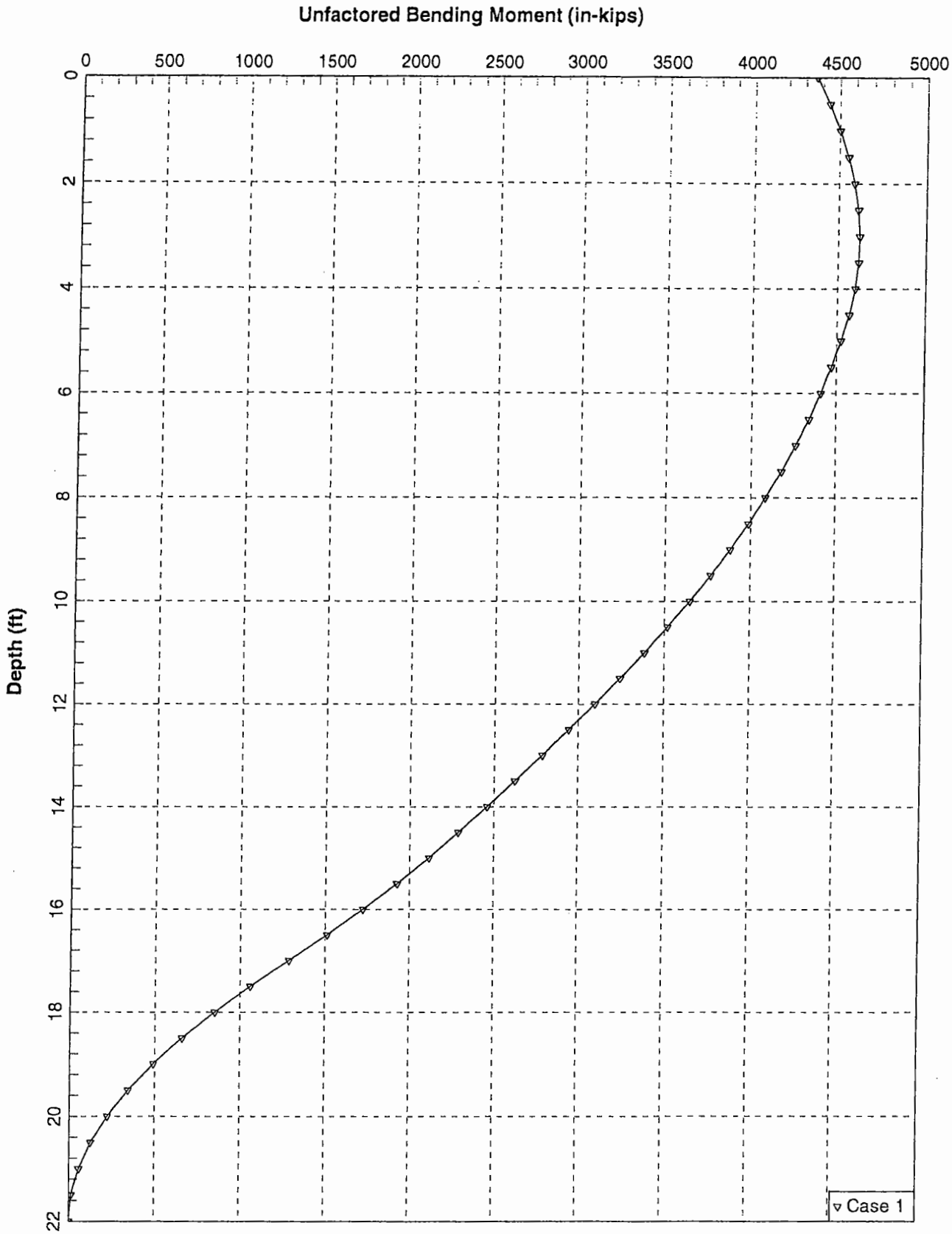
I-580 TOS, CMS, LOCATION 18, 5 FT DIA. CIDH

LOCATION 20

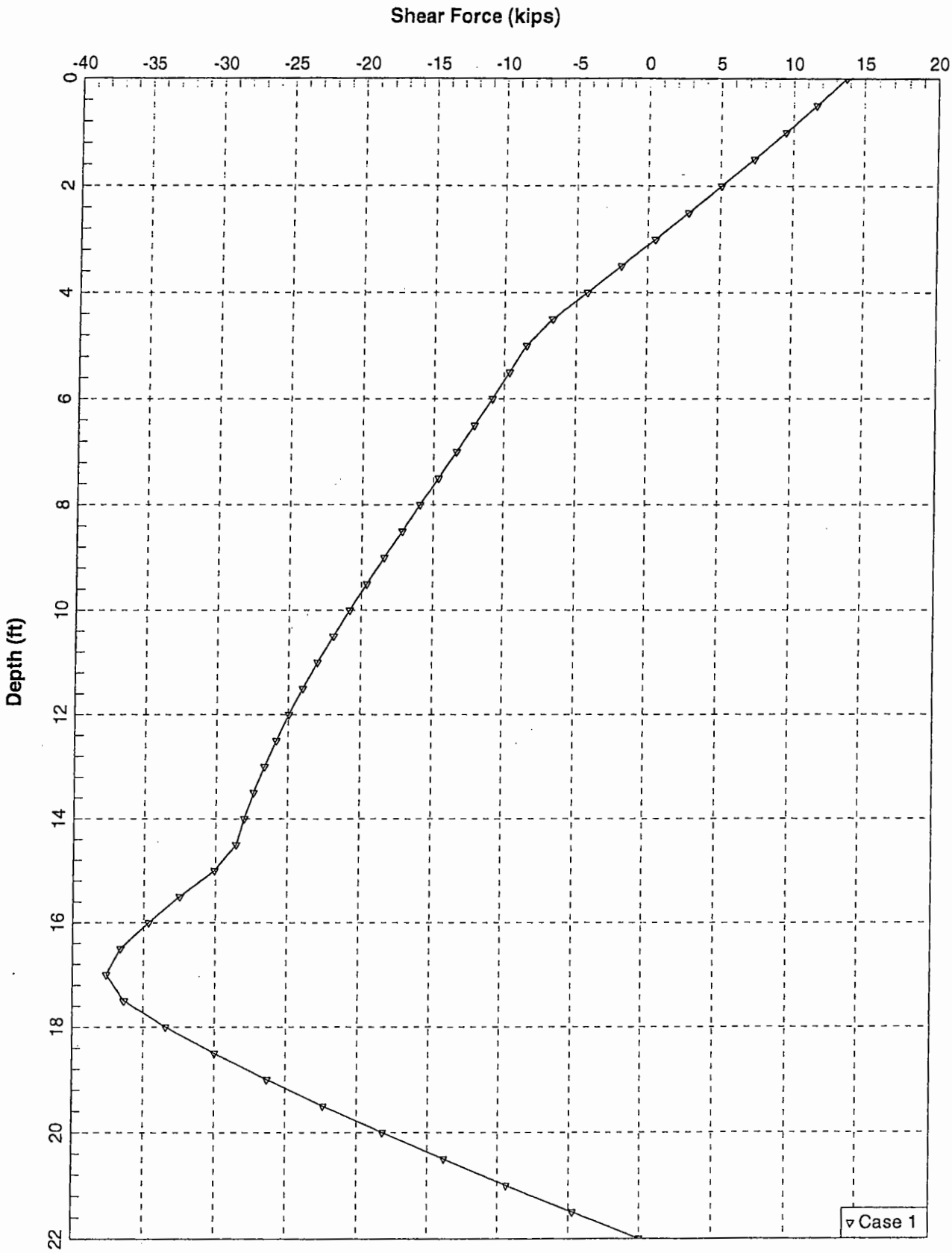
```
LPILEP5
I-580 TOS, LOCATION 7, CMS
1         1         0         0         0         0
44        2         0         264       14
0         60        318086.26           2827.43   3000000
264       60        318086.26           2827.43   3000000
3         6         6         0         0
3         0         60        0         0
4         60        180       39.53     39.53
3         180       264       0         0
0         0.069
60        0.069
60        0.069
180       0.069
180       0.069
264       0.069
0         6.94      0         0.004427            0
60        6.94      0         0.004427            0
60        0         32        0         0
180       0         32        0         0
180       6.94      0         0.004427            0
264       6.94      0         0.004427            0
0         1         0
1
1         13713.35            4363418.8           16860.675
0
1         1         0
100       1E-5      100
```



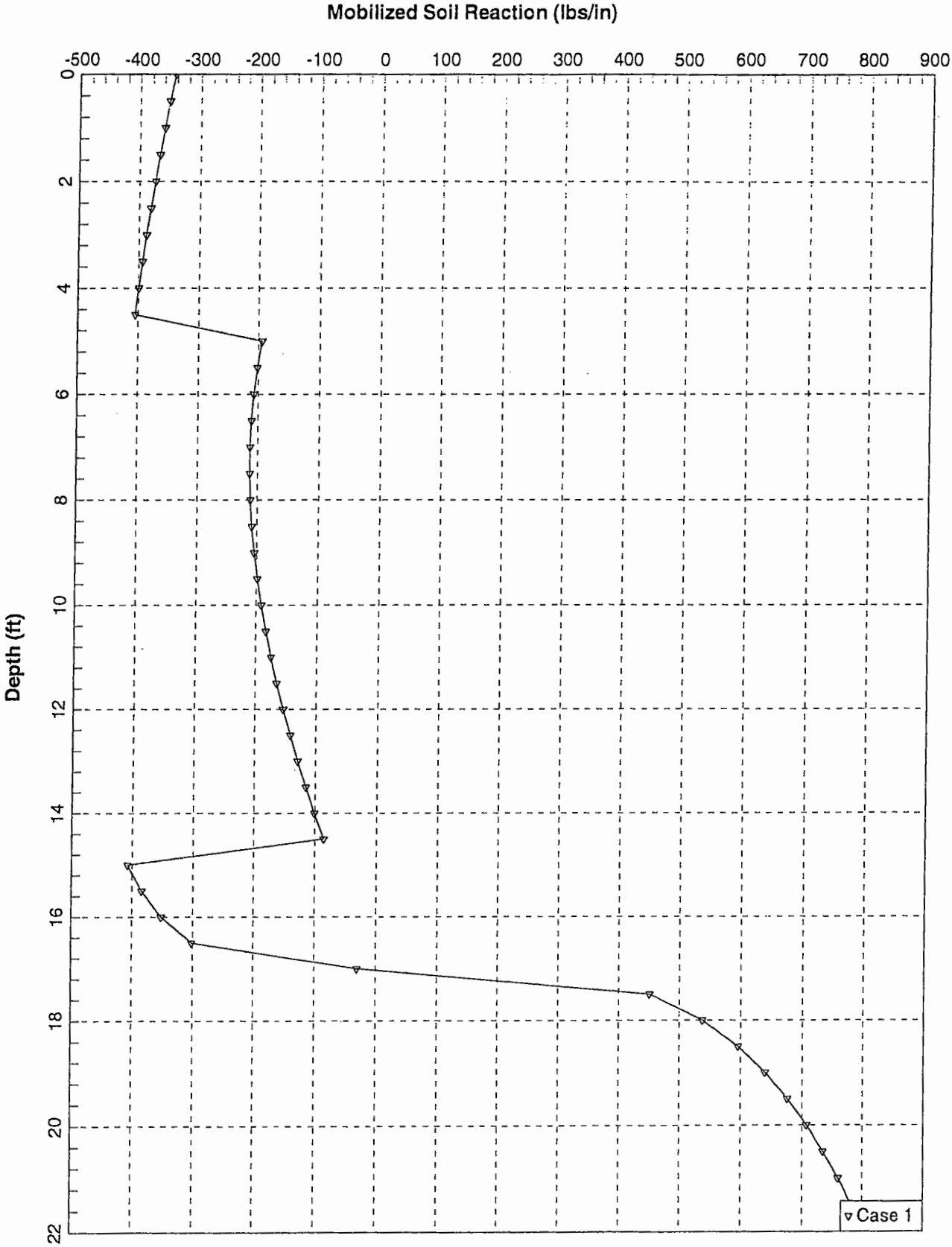
I-580 TOS, CMS, LOCATION 20, 5 FT DIA. CIDH



I-580 TOS, CMS, LOCATION 20, 5 FT DIA. CIDH



I-580 TOS, CMS, LOCATION 20, 5 FT DIA. CIDH



I-580 TOS, CMS, LOCATION 20, 5 FT DIA. CIDH